Focus on **Water Temperatures and Oxygen in Bear-Evans Watershed**

from Ecology's Water Quality Program, Northwest Regional Office

Streams in the Bear-Evans Watershed need your help!

Water that has too little oxygen (called dissolved oxygen) or that is too warm is causing thermal stress and harm to salmon and trout (salmonids) in parts of the watershed and its tributaries, including Bear and Evans Creeks. The unhealthy conditions are causing these streams to fail Washington's water quality standards. These streams serve as important migration corridors and spawning and rearing areas for several salmon species that all need cold waters for optimum health during various stages of their lives. These species include Puget Sound Chinook (listed as threatened under the Endangered Species Act), coho, sockeye, kokanee, and steelhead/rainbow and cutthroat trout.

We can all take actions to fix these problems!

Cool streams and dissolved oxygen are important for water quality

Just as it is necessary for human life, oxygen is essential for salmonids, which need cold, oxygen-rich waters to stay healthy during critical life stages. Cold water holds more dissolved oxygen than warm water, so warmer water results in less oxygen for fish and other aquatic organisms. Fish can then become physically stressed and are more likely to get diseases. If temperatures get above the lethal limit (77°-78°F), most salmonids will become dangerously stressed or die.

Stream temperature and dissolved oxygen standards are set by the Department of Ecology (Ecology) and are reviewed and approved by the federal Environmental Protection Agency. These standards are established to protect the most sensitive beneficial uses of local waters. In the Bear-Evans Watershed, the uses to be protected are salmon and trout spawning, rearing, and migration.

To determine what actions are needed to bring these waters up to Washington standards, Ecology is conducting a water quality study and clean-up project in the Bear-Evans Watershed. Along with its partners, The Department of Ecology is planning the following actions:

- Conduct a water quality technical study -- summer `06
- Develop computer model and analyze water quality data -- spring `07
- Publish the Water Quality Technical Study -- summer `07
- Publish the Water Quality Improvement Plan -- summer `08
- Implement water quality improvement actions! -- ongoing

What causes low dissolved oxygen?

Low dissolved oxygen in streams can be linked to both natural and human-caused events. Some areas, such as wetlands, are naturally low in dissolved oxygen. Ground water entering streams also typically has less oxygen than surface waters.

July 2006 06-10-060

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Human actions also introduce nutrients in streams that result in low dissolved oxygen levels. Failing on-site septic systems and stormwater rushing over areas of reduced vegetation can 'flush' human waste, soaps, domestic animal wastes, and poorly managed fertilizers into our waters. These excess nutrients in streams provide 'food' for algae which can form blooms over large areas. Although algae can contribute some oxygen when they are alive, the problem comes as these algae blooms die and become a food source for oxygen-consuming bacteria. These bacteria thrive on the decomposing algae and deplete dissolved oxygen in water.

Warmer water also speeds the growth of algae, and warm water simply cannot hold as much oxygen as cold water!

What causes high temperature streams?

Some factors that affect stream temperature can occur from both natural and human-causes in the watershed. These include: 1) stream depth, flow rate, and overall volume of water; 2) the influence of cooler ground water flowing into streams; and 3) solar heating [which is related to latitude, time of year, time of day, and how much shade is available to block the sun]. Naturally-occurring fires or floods can also sometimes remove significant streamside vegetation and shade, but humans often cause these events as well. Natural causes, such as high air temperatures can warm creeks and rivers too, as does stream water traveling long distances over exposed bedrock.

Human choices about watershed land management activity often impact stream temperatures:

- Removal of streamside vegetation reduces the amount of shade over the water and makes it easier for the air and sun to heat the stream.
- Erosion and sedimentation from poorly-managed forest lands, agricultural areas, or construction sites can make streams shallower and wider making them harder to shade and more susceptible to warming.
- Water withdrawals for various purposes, including irrigation, reduce the amount of water in the stream during the summer when streams are already low. Having less water in the stream can make it slower and shallower; this allows it to become warmer.
- Changes in the streambed from sediments and erosion can also affect how well colder ground water interacts with surface waters to cool streams.
- Expanded areas of pavement and other impervious surfaces cause runoff water to heat up.

Understanding and correcting problems

When a stream is too warm or has too little dissolved oxygen, Ecology confirms the problem by collecting more water quality data and investigates ways to address the condition. To understand and correct the elevated temperatures and low dissolved oxygen conditions found in the Bear-Evans Watershed, Ecology and its community partners are beginning a detailed monitoring program and data analysis beginning this summer (2006). Ecology scientists will use a computer model that relates stream temperature and dissolved oxygen levels to these factors:

- Streamside vegetation
- Groundwater temperature & inflow
- Water withdrawals
- Characteristics such as stream gradient & aspect, channel incision, & valley topography
- Wind speed
- Stream flow
- Tributary inflow
- Channel conditions such as width and depth
- Air temperature & humidity
- Hyporheic flow (bank storage & exchange)

Thanks for your help to improve Washington's aquatic treasures!

The computer model's results will be used to develop effective solutions that the local community can act on to lower stream temperatures and raise dissolved oxygen levels during critical periods. These water quality improvements can help prevent loss of threatened and endangered fish species and other sensitive organisms in these streams.

How you can help reduce stream temperatures and increase oxygen

Citizens and organizations, including local governments, can take action now to help protect and restore water quality in the Bear-Evans Watershed. The following actions increase dissolved oxygen levels and reduce water temperatures in streams. By taking at least one of the following actions, we can all help improve our streams.

Restore stream channels. Implement streamside restoration projects that address erosion and sedimentation to help prevent stream shallowing and widening. Where streams have been straightened and channelized, restoration projects can help re-establish connections with the natural floodplain and with cool groundwater resources.

Conserve water. Practice wise use of water near streams to help protect flows during late-summer, low-flow conditions. Reduce areas for lawn watering (smaller or summer-tan lawns!), or use less-consumptive irrigation methods such as soaker hoses or smart watering. Use deep soaks early in the morning or late in the evening to minimize evaporation and leave more water in the stream or in our groundwater resources that 'recharge' stream flows.

Plant tree borders. Streamside landowners can plant trees that provide stream shade and cooler temperatures as they mature; cooler water also holds more oxygen. Mature streambank vegetation can also contribute beneficial woody debris to the stream channel and improve water quality by filtering excessive amounts of sediments, fertilizers, or other nutrients from lawns and agricultural areas. This increases ecological health and preserves needed oxygen by preventing the growth of algae and other aquatic plants (see What causes low dissolved oxygen? above).

Keep nutrients and organic material out of streams. Everyone can help maintain healthy levels of dissolved oxygen by taking these actions to further reduce high levels of nutrients in streams or stormwater runoff:

- Routinely check on-site septic systems (every 2-3 years).
- Keep all soaps out of streams. Use only bio-degradables when washing cars on lawns.
- Prevent overuse and runoff of fertilizers. Use slow-release organic fertilizers if possible.
- Carefully manage domestic animal wastes; pick-up, cover, keep away from streams.
- Keep grass clippings and other organic debris out of streams.

Ecology is collaborating with communities in the watershed to identify other ways to cool and provide more oxygen for watershed creeks and tributaries. Citizens and local governments are invited to help develop and implement Water Cleanup Plans for these important waters. Some types of streamside protection measures may be eligible for financial assistance.

For more information about the Bear-Evans Watershed, check the Internet:
http://www.ecy.wa.gov/programs/wq/tmdl/watershed/tmdl_info-nwro.html **or contact:**
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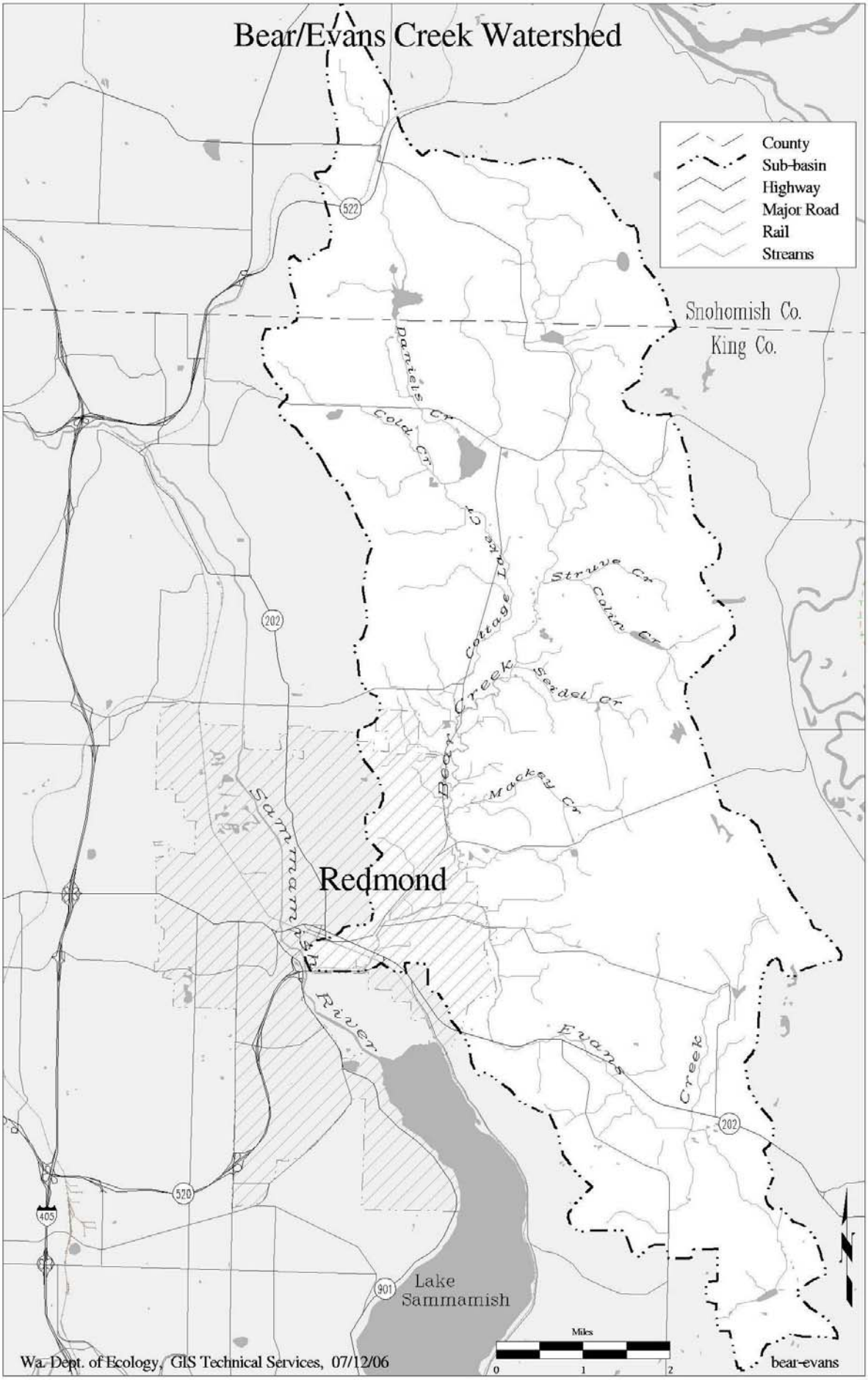
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